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CURRENT LITERATURE

BOOK REVIEWS

Ecology of plants

For a dozen years English and American botanists have been more or less hopefully awaiting a translation of WARMING'S *Plantesamfund*, which was promptly translated into German and thus made available to a larger audience. A peculiar accumulation of misfortunes of one kind or another prevented an English edition of this epoch-making work, but at last WARMING'S contributions are made available to all English and American botanists, and in the most happy way possible, through the preparation of an essentially new book.[1] The author has excellent command of the English language, having frequently contributed articles in this tongue. The new volume was written in English by the author himself, assisted by Dr. MARTIN VAHL, and was prepared for publication by Drs. PERCY GROOM and I. B. BALFOUR. A preface written by the author calls attention to the more fundamental changes in the English work; these are so many and so important that an extended review is necessary.

The introduction contains considerable new matter concerning growth forms (*Lebensformen* or *Vegetationsformen*), together with a new and rather satisfactory classification of them. There are six categories of growth forms: heterotrophic, aquatic, muscoid, lichenoid, lianoid, and all other autonomous land forms. The final category is, of course, much the largest, and is subdivided into monocarpic and polycarpic forms. Monocarpic growth forms may be aestival annuals, hibernal annuals, or biennials to perennials. The polycarpic forms are much more numerous, and their subdivision is based largely on the idea of the character of their protection during the severest seasons, taking account of such things as the duration of the vegetative shoot, the length and direction of the internodes, the position of the renewal buds, the bud structure, size, leaf duration, and the adaptation of the nutritive shoot to transpiration. The sub-classes of polycarpic forms are renascent plants (subdivided into plants with multicipital rhizomes, mat geophytes, and traveling or rhizome geophytes), rosette plants (subdivided into ordinary rosettes and tree rosettes), creeping plants, and plants with erect long-lived shoots (subdivided into cushion plants, undershrubs, soft-stemmed plants, succulent-stemmed plants, and woody plants with long-lived lignified stems).

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[1] WARMING, EUG., assisted by MARTIN VAHL, Oecology of plants; an introducduction to the study of plant communities. Prepared for publication in English by PERCY GROOM and ISAAC BAYLEY BALFOUR. Royal 8vo. pp. xii+424. Oxford: Clarendon Press. 1909. Cloth, $2.90; morocco, $3.25.

The first and second sections, dealing with ecological factors and their action and the communal life of organisms, are but little changed, except that they are brought up to date, as is true of every part of the book to a most remarkable degree. Sun and shade plants are called heliophytes and sciophytes respectively, and their leaves are denominated heliophylls and sciophylls. The third section brings together the parts referring to the adaptations of land and water plants, distributed under various heads in the Danish and German editions. Much more vital, however, involving new conceptions rather than rearrangement of material, is the new classification of plant formations. Here the author departs widely from his former fourfold classification of plants into hydrophytes, mesophytes, xerophytes, and halophytes. The new conception is that there is a fundamental twofold subdivision into land plants and water plants. The land plants are subdivided further into twelve primary groups, thus making with the hydrophytes thirteen main classes of plant formations, in place of the four classes of previous editions. For the new classification, the author states that Dr. VAHL is largely responsible, and especially for those following the psammophytes, as noted below.

In former editions it will be recalled that WARMING objected, and with good reason, to the word formation as an ecological unit, largely because of its varied use by different authors. But language is a peculiar thing, and ill-chosen words often stick. It has been so with formation, and the author now attempts to delimit the word, regarding a formation as "a community of species, all belonging to definite growth forms, which have become associated together by definite external characters of the habitat to which they are adapted." The chief classes of formations are microphyte, moss, herb, undershrub, shrub, and forest, and individual formations may be simple, compound, or mixed. An association is defined as "a community of definite floristic composition within a formation, a floristic species of a formation which is an oecological genus." The conception of a formation as an ecological genus and an association as an ecological species is now becoming generally accepted in principle, but this concrete statement by the father of modern ecology should make its acceptance universal.

The new classification of formations, with some of the leading sub-classes under each, follows.

A. Soil wet; water available. (1) Hydrophytes; subdivided into plankton (further split up into haloplankton, limnoplankton, and saproplankton), cryoplankton (including the microphytes of ice and snow), hydrocharid formations or pleuston, the lithophilous benthos (in place of the nereids), the benthos of loose soil (including hot spring microphytes, sand algae, saprophytic microphytes, and the enhalid and limnaea formations, as in previous editions). (2) Helophytes or swamp plants; subdivided into reed swamps and bush swamps.

B. Soil physiologically dry. (3) Oxylophytes or plants of sour (i. e., acid) soil, characterized largely by xeromorphy; subdivided into low moors, grass heaths, high moors, moss and lichen heaths (or tundra), dwarf shrub heaths, and bushland or forest on acid soil. (4) Psychrophytes or plants of cold soil, including chiefly the subglacial fell-fields. (5) Halophytes; subdivided into lithophilous, psammophilous, and pelophilous halophytes, salt swamps and deserts, and littoral swamp forests (mangrove swamps).

C. Soil physically dry and dominant in determining the vegetation. (6) Lithophytes; subdivided into the true lithophytes (chiefly lichens) chasmophytes, and shingle and rubble plants. (7) Psammophytes or sand plants. (8) Chersophytes or waste plants (i. e., ruderals); subdivided into waste herbage and bushland on dry soil.

D. Climate dry and dominant in determining the vegetation. (9) Eremophytes, or plants of steppes and deserts; subdivided into deserts, shrub steppes, and grass steppes (including prairies). (10) Psilophytes or savanna plants; subdivided into thorny savanna, true savanna, and savanna forest. (11) Sclerophyllous plants; subdivided into garique, maqui, and sclerophyllous forest.

E. Soil physically or physiologically dry. (12) Conifers.

F. Soil and climate favorable to mesophilous formations. (13) Mesophytes; subdivided into arctic and alpine mat grassland, meadow, pasture, mesophytic bushland, deciduous dicotylous forests, and evergreen dicotylous forests.

The classification here outlined does not strike the reviewer as an improvement over the one abandoned. For the most part the new groups of land formations are segregates from the old term xerophyte. It is true that the latter term had become unwieldy, but it is questionable whether the difficulties are solved. Among the advantages of the new scheme is the recognition of close relationship between heath and moor plants, which together form the category oxylophytes, and also the close ecological relationship between these plants and the plants of cold and salty soils, as emphasized by SCHIMPER. It is gainful, too, to put the edaphic xerophytes (lithophytes, psammophytes, chersophytes) into one category and climatic xerophytes (eremophytes, psilophytes, sclerophylls) into another. Among the disadvantages of the new arrangement are many instances where unrelated things are placed together and related things are separated. The most conspicuous case of the former is seen in class 12, the conifers. While this group is a floristic unit, and even an ecological unit from the anatomical standpoint, it is far from being a geographic unit of any sort. It would seem better to put many conifers with the lithophytes and psammophytes, while others are certainly oxylophytes, and others still pronounced mesophytes, the most mesophytic forests of the United States being dominated by conifers. Again, classing the plants of steppes and deserts together as eremophytes does an injustice to the American prairie, much of which is essentially mesophytic. Repetitions in listing the plant formations of a region would be certain to occur, for example as between lithophytes and psammophytes, oxylophytes and psychrophytes in northern regions, etc. It also seems unfortunate that so many Greek derivatives are employed. Nowadays we are getting more and more to abandon the classics and their lengthy derivatives for the vigorous and familiar terms of the vernacular, and it seems a pity to have to brush the dust once more from our Greek lexicons. The antiquated spelling of ecology (oecology) is unfortunate, and is made more striking by contrast with the frequently used economy, which has the same reason for appearing as oeconomy.

While words of adverse criticism seem necessary here and there, one may write volumes of praise. WARMING'S *Plantesamfund* will be for all time the great ecological classic, and the English volume now before us is the most important ecological work in any language. It is at the same time an old book and a new, a translation of the masterpiece of 1895 and a compendium of the ecological thought of 1909. WARMING has been contributing to ecology for more than forty years, and is the undisputed Nestor of the subject, but unlike many a Nestor, WARMING incarnates the ambitions and plasticity of youth. It will be pleasing to American ecologists to see the remarkable recognition accorded to their work in this new volume. The German edition of 1896 contained but one American title, though a half-dozen more might have been included. Now there are 600 titles in all, almost exactly twice the number published in 1896, and it is not unfair to say that half of the ecological work thus far accomplished is represented by the added titles of the last thirteen years. It will be flattering to Americans to note that 115 of the 300 new titles represent American contributions, a record that measures up well with the bare half-dozen that might have been named in the original 300. The new edition has ample footnote references, adding inestimably to the service of the work. The absence of illustrations will be a source of disappointment to many, but it accounts in large part for the extremely low price of the volume, a price that will insure a sale that has been accorded to no ecological work in the English language.—HENRY C. COWLES.

Experimental morphology

Although experimental morphology received its original impetus from observations on plants, during the last few years there has been a great dearth of botanical contributions to this field as compared with what the zoologists have done. It is partly with the hope of stimulating anew botanical exploration in this fascinating field that GOEBEL has published a course of lectures which he delivered in 1906–1907.[2] The field of experimental morphology, perhaps from necessity, is arbitrarily limited to what is often called developmental physiology, no reference being made to the direct influence of gravity, light, etc., on form. The author refers those who wish information on such topics to PFEFFER'S *Physiology* and his own *Organography*. Furthermore, the material presented is mainly from the higher plants, reference being made to KLEBS for similar material on the lower forms.

Especially interesting is the first chapter, which considers the mission of experimental morphology, for here the author reveals his philosophy. It is clear that GOEBEL goes about as far as KLEBS in referring plant phenomena to the influence of external factors, and he follows KLEBS in holding that the ordinary

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[2] GOEBEL, K., Einleitung in die experimentelle Morphologie der Pflanzen. 8vo. pp. vi+260. *figs. 135.* Leipzig and Berlin: B. G. Teubner. 1908. *M* 8.